경제학석사학위논문

How Does the Seller Set the Price?
Analysis on Brand Power with Spatial Price Competition

판매자의 가격결정 행동을 통한 브랜드파워 분석

2014년 8월

서울대학교 대학원

경제학부 경제학 전공

전 석 원

Abstract

How Does the Seller Set the Price?

Analysis on Brand Power with Spatial Price Competition

Soukwon Jun

Department of Economics

The Graduate School

Seoul National University

Firms take into account brand power when establishing marketing strategies. Since firms' marketing strategies are often based on their brand power, the brand power can be measured with the strategies. The purpose of this paper is to suggest a new methodology of measuring the brand power observing marketing strategies in spatial price competition. The assessment tool of the brand power is applied to the gasoline markets in Korea. The model used in this paper shows the spatial price competition, and instrumental variables are introduced into the model, such as time lags and competitors of the competitors. GMM technique is used to estimate the model, and the results from the new approach to measuring the brand power with the estimated parameters show that SK Innovation has the brand power, whereas Hyundai Oilbank and GS Caltex do not have the brand power in the Korean gasoline markets. It is found that S-

Oil has an extremely high brand power, but it may have been a result of other active marketing strategies using a brand character that only S-Oil developed.

Keywords: Brand Power, Spatial Price Competition, GMM

Student Number: 2012-22976

Contents

List of Figures

List of Tables

Introduction

Since the mid-1980s, many researchers have made an effort to measure the effects of brands and their characteristics at the firm level, product level, and consumer level. Many constructs and measurement of the effect of brand have been studied and developed in respect of brand personality, brand image, brand loyalty, the value of brand equity, brand choice, brand experience(Aaker, 1997; Al Biel, 1992; Arjun Chaudhuri and Morris B. Holbrook, 2001; Aaker,1992; Guadagni and Little, 1983; J. Jos ko Brakus and Bernd H. Schmitt, and Lia Zarantonello, 2009). Based on the brand effects evaluated in markets, the managers are able to evaluate and revise their marketing strategies to achieve the ultimate goal, creating profits. Such an important role that brand effects play in marketing activities raises the need for its measurement. Firms take into account brand effects when establishing marketing strategies in order to hold a dominant position in market. The purpose of this paper is to suggest a methodology of the measurement for the brand power.

When setting marketing strategies, there are many factors to consider, such as characteristics of products, price, demand, costs, local characteristics, sales promotion, the number of competitors, distance, brands. Especially, price setting of a product, one of the marketing activities in management, significantly influences purchase behavior of customers. Lakshman Krishnamurthi and S. P. Raj (1991) empirically shows that consumer's preference on brand has an effect on price elasticity in purchase behavior of consumers. The study shows that the consumers who have brand loyalty are less sensitive in purchase decision than the ones who do not. In other words, the brand with loyal consumers secures its own share in the market. This could mean that there exists another market

in which only the firms with the same brand competes for the loyal consumers. If the branded firm has the brand power in market, therefore, a franchise owner setting his strategies will be more sensitive to strategies of competitors with the same brand. As consumers' preference for brands varies, each brand has different level of brand power in market. The brand power of each brand will be measurable if the strategies are observable, which reflects the consumer's preference for brands.

The methodology of the measurement for the brand power is applied to the gasoline markets in Korea. Korean gasoline markets typically show a vertical structure, divided into upstream and downstream. The upstream sector consists of four refineries, such as SK Innovation, S-Oil, Hyundai Oilbank, and GS Caltex, while in the downstream each individual gas station is branded as either SK Innovation, GS Caltex, S-Oil, Hyundail Oilbank, Nong Hyup, or Independent. In the upstream, the refineries seem to be in oligopolistic competition, whereas the individual gas stations in the downstream fiercely compete with one another. Since 2008, Korean policy makers have been relaxing regulation in order to promote competition between suppliers of oil products, to alleviate the vertical structure between the upstream refineries and the downstream individual gas stations, and to therefore stabilize the gasoilne prices in the market.[1] Furthermore, a survey on the purchase behavior of consumers in the Korean gasoline markets conducted by Korean Energy Economics Institutes, KEEI, in August 2010 clearly shows two interesting points to notice. First, it is found that although the gasoline products are almost homogenous, consumers believe

[1]Korean government organized a taskforce on the gasoline price in 2011. Furthermore, the government has been offering consumers the price information for convenience. The government has been also promoting competition in the gasoline markets. It has been supporting independent gas stations and independent importers and allowing the local gas stations to trade with each other. As a result, the vertical structure in the gasoline markets has been eased off.

that the quality of gasoline sold at the gas stations with a specific brand is better than that with any other brand: 38.4% of respondents for SK Innovation, 25.0% for GS Caltex, 15.6% for S-Oil, and 6.8% for Hyundai Oilbank. Second, answering to the qustion about which factor most affects a consumer's choice on the gas station; 53.4% of the respondents said that prices are the most important in purchase decision, 17.2% chose the location, and 9.1% chose membership point accumulation. Since consumers consider the prices most, seller's pricing is possibly the main strategy. It means that fixing the prices in collusion significantly affects consumer welfare, and thus it is the fundamental reason for the stabilization of gasoline prices by government policies. Thus, this paper only takes price setting into account to analyze the brand power in Korean gasoline markets. Given the high market share of SK Innovation[2] and the KEEI survey on the consumers' purchase behavior, as well as the government's policy efforts to stabilize the gasoline prices, the results of measuring the brand power are expected that SK Innovation would have the brand power, if any, whereas GS Caltex, S-Oil, and Hyundai Oilbank would not have the brand power in the gasoline markets.

The rest of this paper is organized as follows. In the next section, the previous studies with respect to spatial competition and gasoline markets are introduced. Then, data and variables used in the model is described in the third section. The fourth section explains the model used, which is specified such that one seller sets the price observing the prices and brands of his competitors placed in his competition boundary. In the fifth section, the estimation results as well as the measurement results of the brand power are illustrated. The sixth section is devoted to the robustness test of the brand power. Finally, the concluding comments on the interpretation of the results, further research, and the impor-

[2]See the section of data for the detail of the market share.

tance of this methodology of measuring the brand power are provided in the sixth section.

Literature Review

In competition among local frachise businesses, the geographical distance between the stores is an important factor. Thus, the spatial concept is introduced into the model. There have been many studies dealing with competition in relation to distance and product differentiation, such as Hotelling model(Hotelling, 1929), Salop's model(Salop, 1979), and Vertical differentiation model(Gabszewicz and Thisse, 1979). Since distance has an effect on competition, we should take account of distance from each competitor, problems of spatial heterogeneity and dependency(Casetti, 1997). By taking distance into account, we can analyze competition between firms more precisely. Joris Pinkse, Margaret E. Slade, and Craig Brett(2002) focused on spatial price competition in U.S. wholesale gasoline markets by a semi-parametric approach for distance. They studied global and local competition based on geographical distance and product characteristics, and concluded that the competition is highly localized. In addition, Harrison Fell and Alan C. Haynie(2013) analyzed that a change of policy from total allowable catch to individual fishing quotas in Alaska sablefish fishery has an effect on behavior of fish processors, allowing for changes of spatial competition over time. Matthas Firgo, Dieter Pennerstorfer, and Christoph Weiss(2012) found out that the strategic interaction in price competition is highly related to firms' degree of centrality in the retail gasoline market in Vienna, using a spatial autoregressive model.

In addition to the studies on spatial competition, there have already been many studies and researches on the effects of the government policies on the gasoline prices and competition of refineries and gas stations. Sang Kwon Kim (2010) studied monopoly power in the gasoline markets in Korea, and found out that the refineries in the upstream do not distort the oil prices of the individual gas stations in the downstream because of free trade of the gasoline from other countries. Dae Wook Kim and Jong Ho Kim (2010) analyzed the effects of competition between branded gas stations and independent gas stations on the oil prices in Korea from 2008 to 2009, considering distance between gas stations. They found that the entry of independent gas stations plays an important role to lower the gasoilne prices. Dong Hun Kim, Hyung Gun Kim, and Ji Yon Lee (2012) seperated the Korean gasoline markets into two parts, one with independent gas stations and the other with no independent gas stations, and also used land values to evaluate place in which a gas station is located. Using difference-in-differences, they carried out that the entry of the independent gas stations lower the oil price. In relation to studies of brand in U.S. gasoline markets, J. Hastings (2004) and C. Taylor, N. Kreisle, P. Zimmerman (2010) analyzed the effects of competition between gas stations by consumer's brand awareness on the gasoline price. Using difference-in-differences methods, Hastings showed that the prices of branded gas stations increased when thrifty gas stations changed their brand names in 1997 in California. Furthermore, M. Lewis (2008) analyzed the price dispersion and local competition between gas stations based on the type of sellers and composition of competitors in San Diego from 2001 to 2002. He concluded that the price dispersion is high under the environment that the gas stations of well-known brand are located in high density of competitors. Although many researchers have studied price competition with respect to brand, distance, and independent gas stations in the

gasoline markets, measurement of brand power has not been their interest. The purpose of this paper is to suggest a new methodology of measuring the brand power and to apply the new assessment tool to the Korean gasoline markets.

Data

In order to assess brand power, seller's pricing in Korean gasoline markets, one of the main marketing strategies, is analyzed. Opinet [3] provides information of each gas station including the gasoline price, self service, brand, address, corporate registration number collected from January 1st of 2009 to March 31st of 2014. All the daily data have been converted to the monthly data.

Figure (1) shows the market share of each brand in Korean gasoline markets over the period considered. As shown in Figure (1), SK Innovation dominates the market most, followed by GS Caltex, Hyundai Oilbank, and S-Oil, although the market share of SK Innovation has fallen from 37.019% to 31.749%.[4]

With Xr-Geocoder [5], first, the address of each gas station is geocoded to the coordinate. In the meantime, gas stations that have missing data and the gas stations that Xr-Geocoder fails to convert the addresses to the coordinates are removed from the data. As a result, 6620 gas stations of all the gas stations in Korea are used to analyze the brand power. The coordinate is used to point each gas station on the map of Korea. Each gas station is identifed by brand,

[3]Since 2008, Korean National Oil Corporation(KNOC) has operated Opinet, a website to disclose the information about gas stations, including the price, to public. http://www.opinet.co.kr

[4]Note that the market share of S-Oil has been increasing, unlike the market share of the other brands.

[5]This program, developed by Hyung Jun Kim, is an open source.
http://www.gisdeveloper.co.kr

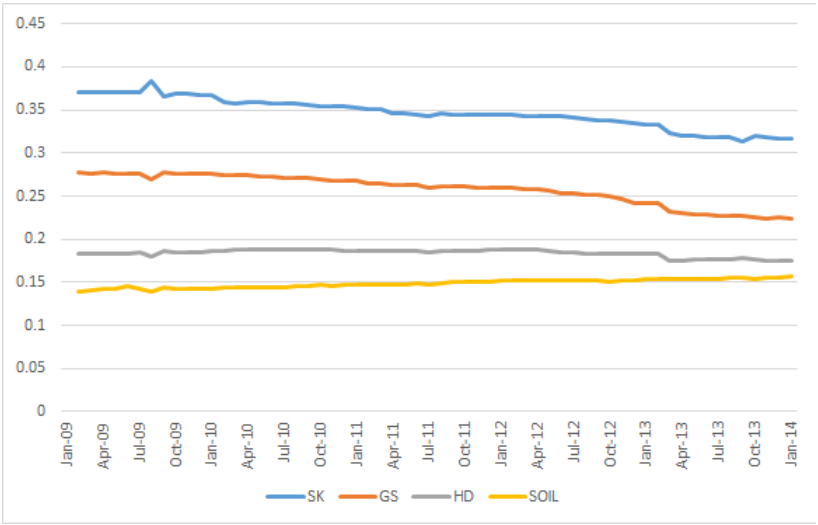

Figure 1 The Market Share of Each Brand over Time

either SK Innovation, GS Caltex, Hyundai Oilbank, S-Oil, or Independent gas stations[6]. Using ArcGIS, second, I set a base boundary as 4km radius to each gas station. Based on the standard boundary, the number of gas stations is considered to control the demand sides. Since the traffic volume on road is not available, the density of the gas station is used instead; high density of the gas station indicates the high demand, while low density indicates low demand. Third, each gas station is identified with a competition boundary of either 4km, 2km, or 1km depending on the degree of the density: 1km for over 40 gas stations, 2km for 20 to 40 stations, 4km for less than 20 stations. Then, the coordinate allows to calculate euclidean distance with Matlab. For exogenous variables, selling prices of refineries are used to control the purchase costs of gasoline for an individual gas station.[7] Since, the purchase costs of the inde-

[6]Although an independent gas station is not branded, the gas station needs to be controled since it lowers prices of branded stations. See "Brand and Competition in the Korean Retail Gasoline Market, Dae Wook Kim & Jong Ho Kim, 2010".

[7]Opinet also provides the information of the purchase costs of the gasoline.

pendent gas station are not open to public, the average costs of all the brands are used instead. Moreover, information of each gas station's operation type, either self service or full service, is handled as a dummy variable. In order to control the local population, the population data at the Dong level[8] from the Ministry of Security and Public Administration is used.

Model

Many previous studies show that the effects of vertical structure between refineries of upstream and individual gas stations of downstream do not exist in the gasoline markets in Korea, implying that the refineries do not affect the local competition of the gas stations. Following the results of the previous studies, the effects of the refineries on the individual gas stations are not considered in this paper. Furthermore, in order to reflect distance on the model of price competition, it is required to set a competition boundary of each gas station because the gas station beyond such distance are not in competition. Therefore, the model used in this paper is the following:

$$P_i = X_i'\beta_i + \sum_{j^c} \sum_{i^c \in i^c(j^c)} \rho_{j^c} m_{i^c} P_{i^c} + u_i \quad (1)$$

$$u_i = \alpha_j + \varepsilon_i \quad (2)$$

, where $i \in i(j)$, and $m_{i^c} = 0$ if $i^c = i$ and $j^c = j$

The model has j sets, the number of brands in Korean gasoline markets. $i(j)$ and $i^c(j^c)$ are the sets of an individual gas station with brand j are j^c

[8] Dong is one of the administrative district units in Korea.

respectively, such that $i(j) = \{i|i = \text{an individual gas station, } j(i) = j\}$ and $i^c(j^c) = \{i^c|i^c = \text{a competitor of an individual gas station, } i(j),\ j^c(i^c) = j^c\}$. $j, j^c = \{\text{SK Innovation, GS Caltex, Hyundai Oilbank, S-Oil, Independent gas station}\}$. P_i is a $t \times 1$ vector of prices of the ith individual gas station with brand j, and X_i is the exogenous variables including local population and costs of gasoline. ρ_{j^c} is the parameter to be estimated for each brand, which shows the average sensitivity of i^c's brand. m_{i^c} is the distance weighting element between an individual gas station, i, and its competitor, i^c. u_i is the error term of an individual gas station with fixed effects of brand, α_j. Finally, ε_i is the white noise.

The model captures the price sensitivity of an individual gas station, i, to the prices and brands of his competitors, controlling for the costs and local population. Taking into account the distance between the seller and each competitor within a competition boundary, distance weighting elements, m_{i^c}, are added to reflect that the pricing of the seller is less affected by the competitors far away from the seller than by the ones close to the seller.

In order to figure out the distance weighting element, m_{i^c}, we need to set the competition boundary of each gas station, κ_i. The competition boundary of each gas station could be decided depending on the demand. The gas stations in urban area are more likely than those in rural area to be located densely because of its high traffic volume. κ_i is decided by a semi-parametric approach of the kernel bandwidth on the distance weighting matrix.[9] The purpose of this approach is to control the demand sides since the data of the traffic volume is not available. It is reasonable to assume that the area in which a lot of gas stations are located has a lot of cars passing by on the road. Thus, κ_i is decided

[9]This is conceptually a kernel bandwidth, but I applied this with the rule of thumb, scrutinizing data used in this paper.

as follows:

$$\kappa_i = \begin{cases} 1 & \text{if } 40 < N(i) \\ 2 & \text{if } 20 < N(i) \leq 40 \\ 4 & \text{if } N(i) \leq 20 \end{cases} \text{, where } i \in i(j)$$

First of all, I set a standard boundary of radius 4km on each individual gas station, i, to count the number of gas stations, $N(i)$. If a gas station has more than 40 gas stations within radius 4km, the competition boundary of the gas station would be radius 1km. For a gas station with 20 to 40 gas stations within the standard boundary, the competition boundary would be radius 2km. Lastly, the competition boundary would be radius 4km for a gas station with less than 20 gas stations.

$$\mu_{i^c} = \begin{cases} \{d_{i^c}\}^{-\beta} & \text{if } 0 < d_{i^c} \leq \kappa_i \\ 0 & \text{otherwise} \end{cases}$$

$$\text{, where } i \in i(j) \text{ and } i^c \in i^c(j^c), \text{ and } \beta = 1$$

Second, for the distance weighting element, the euclidean distance between two gas stations, i and i^c, is calculated from their coordinates. The distance is equal to and less than κ_i by the competition boundary, and κ_i will be either 1km, 2km, or 4km depending on the density of gas stations within the standard boundary set by radius 4km on each gas station. Then, by taking the inverse of the distance, such that $\beta = 1$, the inverse distance element, μ_{i^c}, implies that the nearby gas stations are in more fierce competition than the distant ones. For the first case of $\mu_{i^c} = 0$, consider the first gas station of brand GS Caltex as the competitor of the i^cth gas station with brand j^c for instance. It is trivial

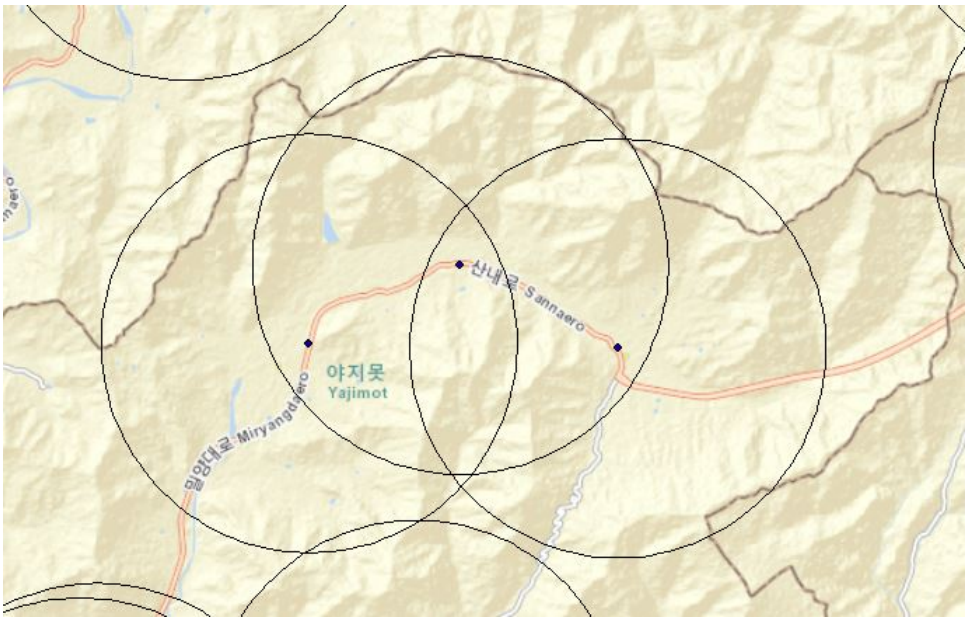

Figure 2 Competitors of the Competitors as Instrumental Variables

that $d_{1(GS)} = 0$ means the distance from itself such that the ith gas station with brand j, is the first gas station of GS Caltex, $i(j) = 1(GS)$, and thus $\mu_{1(GS)} = 0$. In the second case of $\mu_{i^c(j^c)} = 0$, the competitor is located out of the competition boundary of $i(j)$, that is $\mu_{1(GS)} = 0$ if $d_{1(GS)} > \kappa_{i(j)}$.

In order to give relative weights to the competitors based on the inverse of distance, we need to standardize the inverse distance element, μ_{i^c}, in all the competitors of i such that the distance weighting element, m_{i^c}, is the standardized distance matrix. Thus, sum of all the distance weighting elements of the individual gas station, i, is one, $\sum_{i^c} m_{i^c} = 1$.

When estimating the model, the endogeneity problems occur. When a gas station sets prices for its gasoline products, his competitor also considers his price. In order to solve the problem, instrumental variables(IVs) are used in the estimation. Time lagged variables can be used as the IVs, since the model uses

panel data. It implies that the seller does not concern about competitors' past prices any more when setting his prices. Furthermore, prices of the competitors of the competitor are available for the IVs, called spatial lags. Figure (2) shows three gas stations in competition. The left one directly competes with the one in the middle, but not with the right one. However, looking at the Figure (2) carefully, one could notice that the right one is a competitor of the competitor to the left one such that the right one directly affects the middle one to set the prices but does not have a direct effect on the left one. Thus, the prices of the right gas station can be used as the IVs for the left one, instead of the prices of the one in the middle.[10] Since the number of equations are bigger than the number of parameters to be estimated, two step GMM is used to esetimate the model.

As mentioned earlier in the introduction, consumers who have brand loyalty are less sensitive in purchase decision than those who do not. Thus, the brand with consumers' high preference secures its own customers in market. This implies that the branded gas stations with many loyal consumers create their own gasoline market in which only those with the same brand compete. In other words, if a gas station with brand j has the brand power in market, the gas station will be more sensitive to pricing strategy of competitors with the same brand j. Each consumer has different preference for different brands, and thus each brand has brand power to different extents in the market. From the price sensitivities estimated from the prices, the brand power could be measured by the following equation.

$$BP_j = \frac{\rho_j}{\sum_{j^c \neq j} w_{j^c} \rho_{j^c}} > 1 \tag{3}$$

[10]It is possible to use the competitors of the competitors of the competitors to realease the endogeneity.

w_{j^c} is a weighting element[11] on the estimated parameters for the brands j^c, and $\sum_{j^c} w_{j^c} = 1$. To simplify the calculation, all the parameters are assumed to be independent, and $\frac{1}{3}$ is equally taken as w_{j^c}. If the ratio, BP_j, is bigger than 1, it means that the brand power of j exists. If BP_j is equal to 1, then there is no brand power. The robustness of BP_j is tested in the later section.

Results

In this section, the results of estimation on the model are explained, and the brand power is measured with the estimated parameters. First, Figure (3) shows the 6620 points on the map of Korea, indicating the place in which the gas stations are located. Table (1) shows the results of two step GMM on panel data with instrumental varaibles, time and spatial lagged variables.[12] GS, SK, SO, and HD denotes GS Caltex, SK Innovation, S-Oil, and Hyundai Oilbank respectively. As shown in Table (1), an individual gas station branded with GS Caltex responds to competitors with the same brand as much as 0.401 on average. It means that if a competitor branded with GS Caltex increases the price by 1,000 won[13], the seller will increase 401 won in response. In general, each gas station responds more sensitively to his competitors with the same brand than with any other brand when setting the prices except for Hyundai Oilbank.[14] Although Hyundai Oilbank is most price sensitive to S-Oil, its price

[11] Note that this weighting element is different from the distance weighting element, m_{i^c}.
[12] See Appendix for the estimated results from the model.
[13] Won is the Korean currency unit
[14] See Appendix for the detail of interpretation on estimated results of each brand.

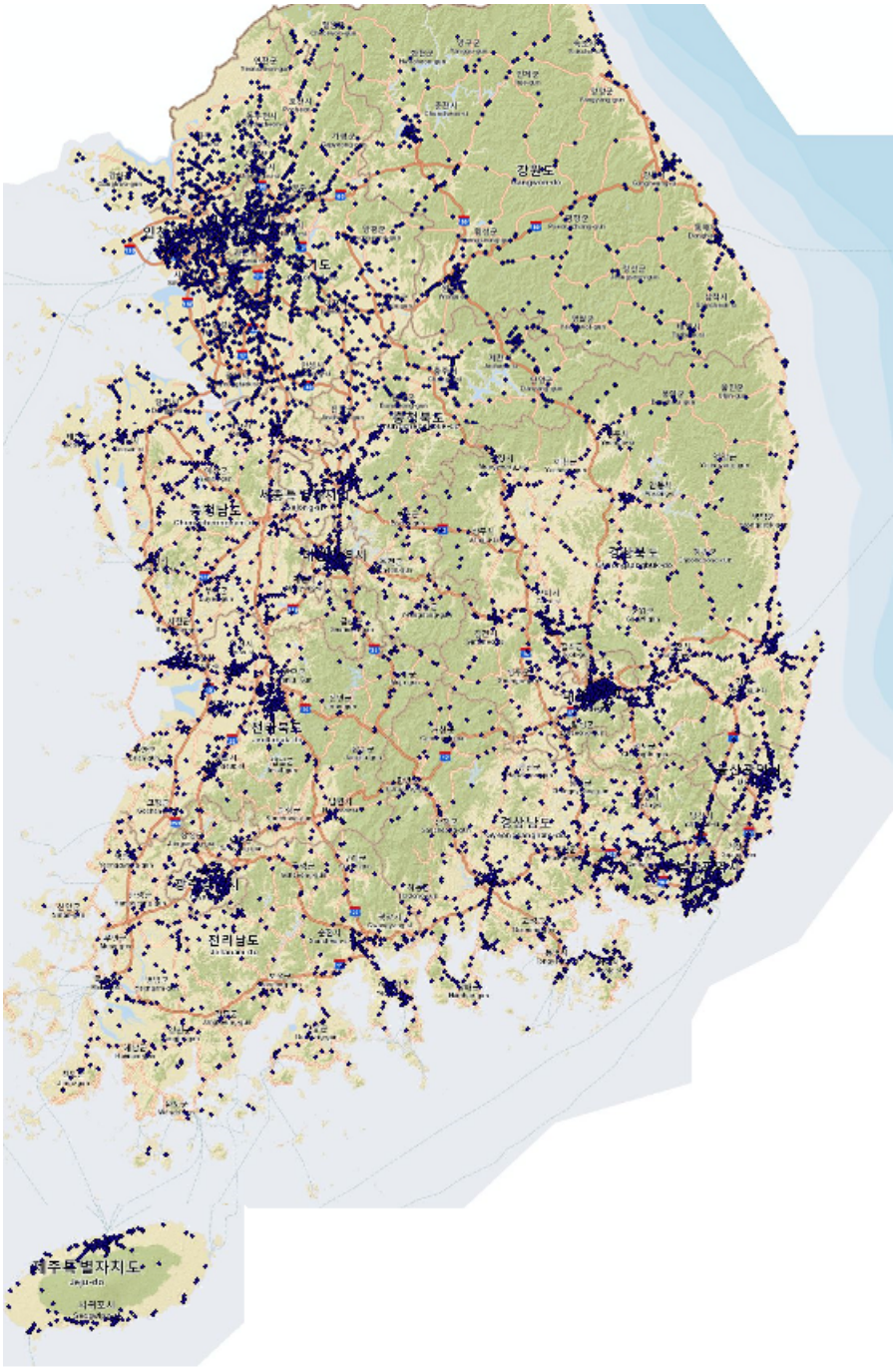

Figure 3 The Points of the Gas Stations on the Map

sensitiveness on S-Oil is not significantly higher than that on the same brand. With the estimated parameters, the brand power can be measured by the measurement tool shown in equation (3). As shown in Table (1), S-Oil is found to be the most powerful brand in Korean gasoline markets, and followed by GS Caltex, SK Innovation, and Hyundai Oilbank. However, the measured values of the brand power need to be tested whether or not it is statistically significant, and it will be explained in more detail in the next section with the robustness test.

	$i(GS)$	$i(SK)$	$i(SO)$	$i(HD)$
ρ_{GS}	0.401	0.410	0.267	0.479
ρ_{SK}	0.264	0.438	0.273	0.466
ρ_{SO}	0.351	0.413	0.625	0.517
ρ_{HD}	0.337	0.315	0.353	0.514
BP_j	1.2634	1.1549	2.0989	1.0552

Table 1 The Results of Estimation and the Measurement of Brand Power

Robustness

In this section, the robustness of the brand power assessed by the measurement tool is tested with delta methods as follows:

$$H_0\text{: } BP_j = 1$$
$$H_1\text{: } BP_j > 1$$

The null hypothesis is $BP_j = 1$. If the null hypothesis is not rejected, it is not statistically significant to suggest that the brand power exists in Korean

gasoline markets although the brand power measured by the measurement tool is over 1.

	GS	SK	$S-OIL$	HD
BP_j	1.2634	1.1549	1.9266	1.0552
P-value	0.0148	0.0023	0.0000	0.4883

Table 2 The Results of Hypothesis Tests

Table 2 shows the results of the hypothesis tests at 99% of the confidence level. Since the brand power of GS Caltex or Hyundai Oilbank cannot reject the null hypothesis, there is not enough statistical evidence to suggest that the brand power of GS Caltex or Hyundai Oilbank exists in Korean gasoline markets. The results showing the existence of the brand power of SK Innovation is acceptable since the market share of SK Innovation in Korean gasoline markets is highest, and consumers perceive the quality of gasoline sold by the gas station branded with SK Innovation as highest, according to the KEEI survey as mentioned ealier in the introduction.[15] Looking at Korean gasoline markets, we expected that the brand power of GS Caltex, S-Oil or Hyundai Oilbank would not exist in the markets. The estimation results coincide with our expectation regarding the brand power of GS Caltex and Hyundai Oilbank, whereas S-Oil is found to have very the strong brand power beyond our anticipation, which requires more explanation. First, in Korean gasoline markets, S-Oil only has a brand character called Goo-Doil[16] for interactive marketing defined as customer involvement in brand building. The effects of the brand character of S-Oil are described in more detail in the following section.

[15] 38.4% of respondents said that the quality of gasoline branded with SK Innovation is better than that with any other brands. The figure was 25.0% for GS Caltex, 15.6% for S-Oil, and 6.8% for Hyundai Oilbank.

[16] It is a doublet of Good and Oil. Good Oil sounds like Korean name, Goo-Doil.

Conclusion

Given the significant effects of brands on purchase behavior of consumers, the brand power should be better understood. This paper suggests the methodology of the measurement for brand power. A loyal consumer for a brand is less sensitive to the prices of its products, showing low price elasticity. In other words, the brand with consumer's high preference secures its own customers in the market. This could mean that there exists another market in which only the firms with the same brand competes for the loyal consumers. Once the branded firm exerts the brand power in market, the firm will be more sensitive to competitors with the same brand in setting the strategies. Each consumer has different preference for different brands, which allows each brand to have brand power to different extents in the market. Then, a firm sets different marketing strategies to reply to each competitor's, and thus we can measure the brand power by observing coping strategies for each competitor's behavior.

The Korean gasoline markets are analyzed in order to measure the brand power of gas stations in which they fiercely compete in price. Fierce price competition implies that price setting could be thought of as the main strategy in marketing. According to the KEEI survey on consumers' purchase behavior, consumers perceive the gasoline quality of SK Innovation is highest and believe the prices of gasoline sold in the gas station branded with SK Innovation most expensive. By scrutinizing Korean gasoline markets, we predicted that the brand power would not exist in the markets or that only SK Innovation would have brand power, if any, to some extent. Brand power could be indirectly measured from

comparing the price sensitivity of an individual gas station to its competitors since pricing is their main marketing strategy.

The distance concepts are introduced into the model. With semi-parametric approach of kernel bandwidth to control the demand sides, each gas station is given with the competition boundary, either 1km, 2km, or 4km based on the number of its competitors within the standard boundary of 4km radius. Since a seller considers his competitors' prices and vice versa, the instrumental variables such as time lagged variables and competitors of his competitors are introduced to the model.

The results from the measurement tool of the brands show that SK Innovation has the brand power to some extent, whereas GS Caltex or Hyundai Oilbank does not have the brand power in Korean gasoline markets. Other than S-Oil, the results of other brands' brand power are significant as we expected. SK Innovation is the brand that consumers perceive the best in Korean gasoline markets in terms of the quality of products. However, S-Oil's brand power is measured as highest, which requires more explanation because consumers ranked S-Oil at the third place in the quality of products, and the market share of S-Oil is also third in the gasoline markets. It is because the estimated model used in this paper only considers prices for seller's marketing strategies. Since the Korean gasoline markets show the fierce competition in price, it could have been reasonable enough to only take the prices into account of marketing activities. However, some of S-Oil's marketing strategies have been differentiated from other brands'. It is the S-Oil's brand character, Goo-Doil. Only S-Oil has used a brand character for interactive marketing, customer involvement in brand building. The well-characterised and visualized character, Goo-Doil

seems to have been increasing top of mind awareness[17] of S-Oil from 50% to 60%. In addition, it may contribute to the increase in the market share of S-Oil from 13.954% to 15.715% in Korean gasoline markets, whereas the market share of other brands has decreased.[18] Goo-Doil has been used as product placement advertisement and been made as souvenir such as dolls and key holders for event supplies, which are available strategies only to S-Oil. Thanks to the innovative strategies, S-Oil won the Presidential award in the '2013 Korea Brand Awards'. Since the active marketing strategy making use of the brand character, Goo-Doil, is managed at the refinery level, the assumption of no effects of the upstream refineries on the downstream individual gas stations may not be suited for analyzing the spatial price competition in Korean gasoline markets. As a result, S-Oil gas stations seem to extremely more consider the competitors branded with the same brand, which may have affected the measurement of the S-Oil's brand power.

This paper has introduced a new methodology of measuring the brand power in the Korean gasoline markets. This is the first attempt to measure the brand power based on the marketing strategies of individual gas stations. Moreover, distance concepts are applied to show spatial price competition and to more accurately analyze the pricing behavior, one of the main marketing strategies. By considering diverse marketing strategies, the model would be improved to assess more accurate brand power. By doing so, the brand power measured from this measurement tool allows managers to comprehend their market position and to set their strategies more effectively and precisely.

[17] It is defined as the first brand that springs to mind when a customer is asked an spontaneous question about a category.

[18] The market share is described in the data in more detail.

References

[1] Aaker, J. L. (1997). Dimensions of brand personality. *Journal of Marketing research*, 347-356.

[2] Anselin, L. (1988). *Spatial econometrics: methods and models (Vol. 4)*. Springer.

[3] Baltagi, B. H., Bresson, G., & Pirotte, A. (2007). Panel unit root tests and spatial dependence. *Journal of Applied Econometrics*, 22(2), 339-360.

[4] Brakus, J. J., Schmitt, B. H., & Zarantonello, L. (2009). Brand experience: what is it? How is it measured? Does it affect loyalty?. *Journal of Marketing*, 73(3), 52-68.

[5] Casetti, E. (1997). The expansion method, mathematical modeling, and spatial econometrics. *International Regional Science Review*, 20(1-2), 9-33.

[6] Chaudhuri, A., & Holbrook, M. B. (2001). The chain of effects from brand trust and brand affect to brand performance: the role of brand loyalty. *Journal of marketing*, 65(2), 81-93.

[7] Davis, P. (2006). Spatial competition in retail markets: Movie theaters. *The RAND Journal of Economics*, 37(4), 964-982.

[8] Del Rio, A. B., Vazquez, R., & Iglesias, V. (2001). The effects of brand associations on consumer response. *Journal of Consumer Marketing*, 18(5), 410-425.

[9] Dodds, W. B., Monroe, K. B., & Grewal, D. (1991). Effects of price, brand, and store information on buyers' product evaluations. *Journal of Marketing Research (JMR)*, 28(3).

[10] Elhorst, J. P. (2014). Spatial panel data models. In *Spatial Econometrics (pp. 37-93)*. Springer Berlin Heidelberg.

[11] Fell, H., & Haynie, A. C. (2013). Spatial Competition with Changing Market Institutions. *Journal of Applied Econometrics*, 28(4), 702-719.

[12] Firgo, M., Pennerstorfer, D., & Weiss, C. (2012). Centrality and pricing in spatially differentiated markets (Doctoral dissertation, Doctoral Thesis, WU Vienna University of Economics and Business, available online at http://epub. wu. ac. at/3461, last accessed 29/11).

[13] Hastings, J. S. (2004). Vertical relationships and competition in retail gasoline markets: Empirical evidence from contract changes in southern california. *American Economic Review*, 317-328.

[14] Hotelling, H. (1990). Stability in competition (pp. 50-63). Springer New York.

[15] Hoyer, W. D., & Brown, S. P. (1990). Effects of brand awareness on choice for a common, repeat-purchase product. *Journal of consumer research*, 17(2), 141.

[16] Kalnins, A. (2003). Hamburger prices and spatial econometrics. *Journal of Economics & Management Strategy*, 12(4), 591-616.

[17] Kapoor, M., Kelejian, H. H., & Prucha, I. R. (2007). Panel data models with spatially correlated error components. *Journal of Econometrics*, 140(1), 97-130.

[18] Keller, K. L. (1993). Conceptualizing, measuring, and managing customer-based brand equity. *The Journal of Marketing*, 1-22.

[19] Krishnamurthi, L., & Raj, S. P. (1991). An empirical analysis of the relationship between brand loyalty and consumer price elasticity. *Marketing Science*, 10(2), 172-183.

[20] Lattin, J. M., & Bucklin, R. E. (1989). Reference effects of price and promotion on brand choice behavior. *Journal of Marketing Research (JMR)*, 26(3).

[21] LeSage, J. P., & Pace, R. K. (Eds.). (2004). *Spatial and spatiotemporal econometrics (Vol. 18)*. Gulf Professional Publishing.

[22] LeSage, J., & Pace, R. K. (2008). *Introduction to spatial econometrics.* CRC press.

[23] Lewis, M. (2008). Price dispersion and competition with differentiated sellers*. *The Journal of Industrial Economics*, 56(3), 654-678.

[24] McMillen, D. P., Singell, L. D., & Waddell, G. R. (2007). Spatial competition and the price of college. *Economic Inquiry*, 45(4), 817-833.

[25] Pennerstorfer, D. (2009). Spatial price competition in retail gasoline markets: evidence from Austria. *The Annals of Regional Science*, 43(1), 133-158.

[26] Pinkse, J., Slade, M. E., & Brett, C. (2002). Spatial price competition: a semiparametric approach. *Econometrica*, 70(3), 1111-1153.

[27] Pinkse, J., & Slade, M. E. (2004). Mergers, brand competition, and the price of a pint. *European Economic Review*, 48(3), 617-643.

[28] Salop, S. C. (1979). Monopolistic competition with outside goods, *Bell Journal of Economics*, 10, 141-156.

[29] Schmidt, T. (1994). An analysis of intrabrand competition in the franchise industry. *Review of Industrial Organization*, 9(3), 293-310.

[30] Shapiro, C. (1995). Mergers with differentiated products. *Antitrust*, 10, 23.

[31] 김대욱, & 김종호. (2010). 휘발유 소매시장에서 브랜드와 경쟁에 관한 연구. *산업조직연구*, 18(2), 75-95.

[32] 김동훈, 김형건, & 이지연. (2012). 자가폴주유소의 시장진입과 가격경쟁 효과에 대한 연구. *산업조직연구*, 20(3), 1-21.

[33] 김상권. (2010). 휘발유시장에서의 독점력 추정. *규제연구*, 19(2), 137-155.

[34] 김형건, 원두환, et al. (2010). 소비자의 주유소 구매행태 설문조사. *한국에너지경제연구원(KEEI)*

[35] 남재현, & 오선아. (2010). 직/자영 소유구조의 주유소 가격효과. *산업조직연구*, 18(2), 19-41.

[36] 조영선. 티저(Teaser)광고에서 알레고리(Allegory)의 효과 및 가능성에 관한 연구. 광고·멀티디자인학 석사 학위논문, 홍익대학교 대학원, 2013

[37] 원창선, & 노정구. (2010). 석유제품 브랜드의 자산 가치 측정: 휘발유를중심으로. *한국에너지경제연구원(KEEI)*, 19-36

[38] 이상미. 알뜰주유소 정책이 국내석유제품 가격에 미친 영향 분석. 공기업정책학 석사 학위논문, 서울대학교 행정대학원, 2013.

[39] (2013). 나만의 구도일 캐릭터 만들시 ; 에쓰-오일 구도일 프로모션. *(사)한국인터넷전문가협회, Web Korea Annual*, 2013(0), 197-198.

[40] BizGis, *http://www.biz-gis.com*

[41] Korea National Oil Corperation(KNOC), *http://www.knoc.co.kr*

[42] Ministry of Security and Public Administration(MOSPA), *http://www.mospa.go.kr*

[43] Opinet, *http://www.opinet.co.kr*

Appendix

This section shows the estimation results of each brand with two step GMM. Each of GS, SK, SO, HD, and NP denotes GS Caltex, SK Innovation, S-Oil, Hyundai Oilbank, or Independent gas station in order. As one can notice, all the results do not describe correlation between population and price setting. The parts of population are removed from the result tables because population does not significantly have an effect on seller's price setting.[19]

GS	Coef.(ρ^j)	Std.Err	P-Value
GS	0.401	0.034	0.000
SK	0.264	0.020	0.000
SO	0.351	0.035	0.000
HD	0.337	0.032	0.000
NP	0.303	0.084	0.000
$Costs$	0.796	0.018	0.000

Table 3 Estimation Results of GS Caltex

As shown in Table (3), every seller of an individual gas station branded with GS Caltex responds to its competitors with the same brand as much as 0.401 on average. It means that if the competitor of the same brand increases the price 1,000 won, the Korean currency unit, the seller will increase 401 won in response.

Table (4) shows the estimation results of SK Innovation. The individual gas station branded with SK Innovation considers its competitors more with the same brand than with any other brand when its seller sets prices.

Table (5) describes the estimation results of S-Oil. The sensitivity to prices

[19]In fact, the estimated values were very close to 0. Since the model was specified with space, all the individual gas stations within a competition boundary have the same local characteristics so that the model may not have captured the effects from the local characteristics on the individual gas stations close to one another.

SK	Coef.(ρ^j)	Std.Err	P-Value
GS	0.410	0.025	0.000
SK	0.438	0.018	0.000
SO	0.413	0.029	0.000
HD	0.315	0.022	0.000
NP	0.238	0.048	0.000
$Costs$	0.732	0.015	0.000

Table 4 Estimation Results of SK Innovation

$S-Oil$	Coef.(ρ^j)	Std.Err	P-Value
GS	0.281	0.033	0.000
SK	0.273	0.025	0.000
SO	0.588	0.060	0.000
HD	0.361	0.041	0.000
NP	0.233	0.060	0.000
$Costs$	0.805	0.023	0.000

Table 5 Estimation Results of S-Oil

of the individual gas station with the same brand is stronger than the results of any other brand. Since the results are not consistent with the expectation, more explanation is needed to interprete the results, and they may be caused by other marketing strategies of S-Oil, the brand character, Goo-Doil.

HD	Coef.(ρ^j)	Std.Err	P-Value
GS	0.479	0.040	0.000
SK	0.466	0.028	0.000
SO	0.517	0.050	0.000
HD	0.514	0.037	0.000
NP	0.286	0.079	0.000
$Costs$	0.642	0.023	0.000

Table 6 Estimation Results of Hyundail Oilbank

As shown in all the results of brands, an independent gas station has an

effect on a branded gas station in some degree, consistent with the results of previous studies. Furthermore, all the results show that the gasoline costs to an individual gas station are more influential in a seller's price setting than any competitor's prices.

국문초록

기업의 전략은 상대 경쟁자의 전략에 따라 설정되는데, 이 때 기업은 브랜드 파워를 고려한다. 즉, 브랜드 파워는 마케팅 전략을 결정하는데 기반이되므로, 기업의 브랜드 파워의 크기는 기업의 전략을 관찰함으로써 측정 가능하다. 따라서 이 논문은 마케팅 전략을 통해 브랜드 파워의 크기를 측정하는 새로운 방법론을 제시하고자 한다. 이 측정도구를 한국의 주유소 시장에 적용하여, 한국의 정유사 브랜드 파워를 측정해 보았다. 주유소 시장의 브랜드 별 개별 주유소의 공간가격경쟁을 모형화했으며, 내생성을 완화시키기 위해 도구변수로서 경쟁 주유소의 과거가격과 경쟁자들의 경쟁자들의 가격을 이용하였다. GMM을 이용한 추정결과는 한국의 주유소 시장에서 SK Innovation이 브랜드 파워가 다소 있으며, GS Caltex와 Hyundai Oilbank는 브랜드 파워가 존재하지 않았다. 추정결과는 S-Oil이 브랜드 파워가 매우 높은 것으로 나타나는데, 이는 S-Oil의 브랜드 캐릭터를 앞세운 S-Oil만의 활발한 마케팅 전략 때문인 것으로 추측된다.

주요어: 브랜드 파워, 공간가격경쟁, GMM

학번: 2012-22976